



[7590-01-P]

NUCLEAR REGULATORY COMMISSION

[Docket Nos. 50-313, 50-368, 72-13, and 72-1014; NRC-2014-0270]

Independent Spent Fuel Storage Installation, Entergy Operations, Inc.;

Arkansas Nuclear One, Units 1 and 2

AGENCY: Nuclear Regulatory Commission.

ACTION: Exemption; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing an exemption in response to an October 2, 2014, request from Entergy Operations, Inc., (Entergy or licensee) from the requirement to comply with the terms, conditions, and specifications in Section 2.1 of Appendix B of the Technical Specifications for certificate of compliance (CoC) No. 1014, Amendment No. 5.

DATES: Notice of issuance of exemption given on **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Please refer to Docket ID NRC-2014-0270 when contacting the NRC about the availability of information regarding this document. You may obtain publicly-available information related to this document using any of the following methods:

- **Federal Rulemaking Web Site:** Go to <http://www.regulations.gov> and search for Docket ID NRC-2014-0270. Address questions about NRC dockets to Carol Gallagher; telephone: 301-287-3422; e-mail: Carol.Gallagher@nrc.gov. For technical questions, contact the individual listed in the FOR FURTHER INFORMATION CONTACT section of this document.

- **NRC's Agencywide Documents Access and Management System (ADAMS):**
You may obtain publicly available documents online in the ADAMS Public Documents collection at <http://www.nrc.gov/reading-rm/adams.html>. To begin the search, select "[ADAMS Public Documents](#)" and then select "[Begin Web-based ADAMS Search](#)." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov. The ADAMS accession number for each document referenced in this document (if that document is available in ADAMS) is provided the first time that a document is referenced.

- **NRC's PDR:** You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

FOR FURTHER INFORMATION CONTACT: Chris Allen, Office of Nuclear Material Safety and Safeguards, telephone: 301-287-9225, e-mail: William.Allen@nrc.gov; U.S. Nuclear Regulatory Commission, Washington, DC 20555.

SUPPLEMENTARY INFORMATION:

I. Background.

Entergy is the holder of Facility Operating License Nos. DRP-51 and NPF-6, which authorize operation of ANO, Units 1 and 2, in Russellville, Arkansas, pursuant to part 50 of title

10 of the *Code of Federal Regulations* (10 CFR). The licenses provide, among other things, that the facility is subject to all rules, regulations, and orders of the NRC now or hereafter in effect.

Under subpart K of 10 CFR part 72, a general license has been issued for the storage of spent fuel in an independent spent fuel storage installation (ISFSI) at power reactor sites to persons authorized to possess or operate nuclear power reactors under 10 CFR part 50. Entergy is licensed to operate a nuclear power reactor under 10 CFR part 50, and authorized under the 10 CFR part 72 general license to store spent fuel at the ANO ISFSI. Under the terms of the general license, Entergy stores spent fuel using the Holtec International (Holtec) HI-STORM 100 System CoC No.1014 at ANO.

II. Request/Action.

While performing drying operations on a loaded Holtec HI-STORM 100 Model 24 Multi-Purpose Canister (MPC-24), serial number MPC-24-060, Entergy detected Krypton-85 (Kr-85) gas. Kr-85 gas is a fission product gas and its presence may indicate fuel rods with greater than pinhole leaks or hairline cracks. Section 2.1 of Appendix B of the Technical Specifications for the HI-STORM 100 CoC No. 1014 specifies that only intact fuel assemblies, which is defined as fuel assemblies without known or suspected cladding defects greater than pinhole leaks or hairline cracks and which can be handled by normal means, are authorized for loading into an MPC-24 canister. Entergy stated that although all fuel assemblies loaded into MPC-24-060 were tested subsequent to their final operating cycle using standard, accepted methods (i.e., in-mast sipping and ultrasonic testing), and were visually inspected for indications of rod damage, assembly damage, or other potential issues before being loaded into the canister, a fuel assembly with a defect greater than a pinhole leak or hairline crack may have been loaded into MPC-24-060.

By letter dated October 2, 2014, as supplemented October 14 and November 7, 2014 (ADAMS Accession Nos. ML14279A246, ML14289A239, and ML14311A121, respectively), Entergy requested an exemption from the following requirements to allow storage of MPC-24-060 in its current, as-loaded, condition at the ANO ISFSI:

- 10 CFR 72.212(a)(2), which limits the storage of spent fuel to casks approved in subpart K of 10 CFR part 72.
- 10 CFR 72.212(b)(11), which states, in part, that the “licensee shall comply with the terms, conditions, and specifications of the CoC ...”

III. Discussion.

Pursuant to 10 CFR 72.7, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of the regulations of 10 CFR part 72 as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. In addition to the requirements from which Entergy requested exemption, the NRC determined exemption from the following requirements would be necessary to authorize Entergy's proposal:

- 10 CFR 72.212(b)(3), which requires that each cask used by the general licensee conforms to the terms, conditions, and specifications of a CoC listed in § 72.214.
- 10 CFR 72.212(b)(5)(i), which requires written evaluations be performed before use that a loaded cask will conform to the terms, conditions, and specifications of a CoC listed in § 72.214.
- 10 CFR 72.214, which lists the casks approved for storage of spent fuel under conditions specified in their CoCs.

Authorized by Law

This exemption would allow the licensee to store MPC-24-060 (loaded with spent nuclear fuel assemblies which are not authorized per Section 2.1 of Appendix B of the Technical Specifications for CoC No. 1014, Amendment No. 5) in its as-loaded configuration at the ANO ISFSI. The provisions in 10 CFR part 72 from which Entergy requested an exemption, as well as the provisions considered by the NRC, require the licensee to comply with the terms, conditions, and specifications of the CoC for the approved cask model that it uses.

Section 72.7 allows the NRC to grant exemptions from the requirements of 10 CFR part 72. Issuance of this exemption is consistent with the Atomic Energy Act of 1954, as amended, and not otherwise inconsistent with NRC regulations or other applicable laws. As explained below, the proposed exemption will not endanger life or property, or the common defense and security, and is otherwise in the public interest. Therefore, the exemption is authorized by law.

Will Not Endanger Life or Property or the Common Defense and Security

The requested exemption would allow the licensee to store MPC-24-060 (loaded with spent nuclear fuel assemblies which are not authorized per Section 2.1 of Appendix B of the Technical Specifications for CoC No. 1014, Amendment No. 5) in its as-loaded configuration at the ANO ISFSI.

In support of its exemption request, the licensee submitted Holtec Report HI- 2146265, "Justification for ANO Exemption Request for Loading of Damaged Fuel in MPC-24," Rev. 0 (ADAMS Accession No. ML14279A246). Holtec stated that the most likely source of the Kr-85 gas was a single breached rod in one fuel assembly and that it is unlikely that the cladding defects would allow fuel pellets to be released into the canister cavity. Nevertheless, as discussed further below, Holtec assumed in its thermal, criticality, and shielding analyses that multiple breached fuel rods had been loaded into MPC-24-060 and that fuel pellets had been released into the canister cavity. Based upon the fact that only trace amounts of Kr-85 gas

were detected after the initial alarm annunciation, NRC staff concludes that these are conservative assumptions and therefore finds them acceptable.

The Holtec report asserted that, since the damaged fuel rods do not contact either the HI-STORM overpack or the HI-TRAC transfer cask, they will have no impact on the structural performance of either the HI-STORM overpack or the HI-TRAC transfer cask. Also, the normal, off-normal, and accident condition pressures and temperatures specified in Tables 2.2.1 and 2.2.3 of Revision 7 of the HI-STORM Final Safety Analysis Report (FSAR) are not exceeded as a result of the damaged fuel rods (ADAMS Accession No. ML110250163). Furthermore, the report stated that the stresses in the overpack and the transfer cask due to normal and off-normal handling events remain as calculated in the HI-STORM FSAR since the dead weight of the loaded casks and their centers of gravity are unaffected by the damaged fuel rods. In addition, the impact decelerations experienced by the cask as a result of either a handling accident or a hypothetical tip-over event are not increased, and the stability of the cask under design basis natural phenomena events (i.e., tornado winds, earthquake, etc.) continues to be assured. The staff reviewed the structural evaluation provided by the applicant and the basis of its conclusions. Based on its review of the representations, determinations, and information provided by the applicant in the above mentioned Holtec report, the NRC staff concludes continued storage of one or more fuel assemblies with fuel rods having greater than a pinhole leak, not placed in a damaged fuel container, and loaded into a HI-STORM 100 MPC-24 will have no impact on the ability of the HI-STORM overpack, HI-TRAC transfer cask, or the MPC to withstand pressure loads due to tornado winds, floods, or explosions. The NRC staff also concludes that there is a reasonable assurance that the overpack and transfer cask's structural performance will meet the requirements of 10 CFR part 72.

In Chapter 5 of Revision 7 to the HI-STORM FSAR, Holtec stated that storage of damaged fuel assemblies is identical from a shielding perspective to storage of intact fuel assemblies (ADAMS Accession No. ML082401632). Dose rate measurements performed by

Entergy which show that the dose rates for MPC-24-060 are below the limits specified in the CoC support the results presented in the Holtec FSAR. The shielding analyses performed for accident conditions in Chapter 5 of Revision 7 to the HI-STORM FSAR simulated four collapsed, damaged fuel assemblies located on the periphery of an MPC-24. Since there are approximately 208 fuel rods in a fuel assembly, this equates to approximately 832 collapsed fuel rods. The results of these analyses showed that external dose rates at the bottom of the canister increased by less than 27% and dose rates at higher locations decreased. Since the number of damaged fuel rods assumed in the Holtec report is much less than that described in the FSAR analysis, the applicant stated that the effect on dose for MPC-24-060 loaded with fuel assemblies having defects greater than pinhole leaks and hairline cracks would be expected to be less than that described in the FSAR. Similarly, according to the Holtec report the postulated relocation of the fuel from a small number of rods would have a negligible effect on the dose contribution at the site boundary. Additionally, Chapters 7 and 11 of Revision 7 to the HI-STORM FSAR shows that leakage is not credible under normal, off-normal, and accident conditions (ADAMS Accession No. ML082401621 and ML082401626 respectively). The NRC staff reviewed Revision 7 to the HI-STORM 100 FSAR and information provided by the applicant and found that analysis acceptable to demonstrate the dose rates for MPC-24-060. Based on its review, the NRC staff finds that storage of fuel assemblies having greater than pinhole leaks and hairline cracks in the HI-STORM 100 MPC-24 Storage System will meet the dose rate and exposure limit requirements in 10 CFR part 20 and 10 CFR part 72.

Holtec assumed one fuel pin per assembly is damaged in each of the 24 assemblies loaded into MPC-24-060. The criticality evaluation indicated the potential relocation of fuel pellets from damaged fuel rods in the MPC has a negligible effect on the reactivity of the system, and the maximum reactivity remains well below 0.95. During storage operations, the MPC is internally dry, resulting in a low reactivity and large reactivity margins. For unloading operations, where the MPC is flooded, confirmatory calculations for possible relocation of fuel

both within and outside of an assembly confirmed that the effect of fuel relocation on the reactivity of the system is small even if the MPC is flooded with unborated water. The NRC staff has reviewed the criticality evaluation and the basis of the conclusions reached by Holtec in support of Entergy's exemption request. Based on its review of the representations, determinations, and information provided, the NRC staff finds that the as-loaded potentially damaged fuel will not impact the criticality performance of the HI-STORM 100 MPC-24 Storage System, and therefore, as loaded, MPC-24-060 will meet the criticality safety requirements of 10 CFR part 72.

The staff also finds that there is no impact on the ability of the fuel to be retrieved from the canister for the following reasons. A complete break of a fuel rod on the periphery of a fuel assembly could affect retrievability; however, this condition was not identified by the visual inspections performed during loading. Also, the amount of gas released is not indicative of a complete break of a fuel rod. Expanded damage of breached rod(s) during storage could make handling of the fuel at a later time more difficult than if it was repackaged at the current time. However, the only degradation mechanism which could further damage the fuel is oxidation of exposed fuel pellets. Oxidized fuel pellets would exert stress on the cladding, potentially causing further damage and release of fuel pellets. Since the MPC has been seal welded shut and an inert atmosphere of helium has been introduced into the cavity, unless there is a breach of containment letting air into the canister, oxidation of the pellets will not occur. Consequently, the cladding will not be damaged further and fuel pellets will not be released. Therefore, NRC staff finds that storage of fuel assemblies having greater than pinhole leaks and hairline cracks in the HI-STORM 100 MPC-24 Storage System will meet the retrievability requirements of 10 CFR part 72.

As part of its thermal assessment of storage of the damaged fuel in a HI-STORM 100 MPC-24, Holtec stated that the damaged fuel rods in the canister would be well below 1% of the total number of fuel rods (approximately 50 fuel rods). Holtec evaluated the effect of damaged

fuel on the different heat transfer mechanisms while the canister is in the storage configuration. Holtec stated that the damaged rods would remain in their correct physical positions within the fuel assembly and that the fuel assembly geometry is unchanged. Therefore, both the conduction heat transfer mechanism and the radiation heat transfer mechanism would not be impacted. Holtec also stated that the resistance to movement of helium within the fuel assemblies (i.e., the hydraulic resistance that is also dependent on the fuel geometry) is unaffected. Consequently, the natural convection heat transfer mechanism, which is dependent upon the hydraulic resistance, would not be impacted. Even though Holtec believes the fuel rods are intact, Holtec evaluated the impact on the natural convection heat transfer mechanism within the canister from either fuel pellets or pieces of fuel cladding becoming dislodged from the damaged fuel rods. Holtec stated that, if a fuel pellet or piece of fuel cladding were to block one of the rod-to-rod interstitial spaces, the impact on the natural convection heat transfer would be very small because each interstitial space is connected to four adjacent rod-to-rod interstitial spaces. Therefore, helium could easily flow around any blocked rod-to-rod interstitial space. Holtec also stated that, if a fuel pellet or piece of fuel cladding were to fall completely out of the fuel assembly and into the bottom region of the fuel basket, the impact on the natural convection heat transfer mechanism due to helium circulation would be similarly negligible because openings in the bottom region of the fuel basket are sized sufficiently large enough to allow the movement of helium within the canister.

The NRC staff reviewed Holtec's evaluation on the impact of damaged spent fuel on the MPC-24 thermal performance discussed above and determined that it demonstrated that the presence of damaged fuel (to the extent described in the technical justification) would not affect the heat transfer characteristics (i.e., conduction heat transfer, radiation heat transfer, and natural convection heat transfer by helium circulation). Since the impact on the thermal performance is small and because the total cask heat load is relatively low as compared to the design basis heat load, the staff concludes that neither temperature nor pressure limits in the

FSAR would be exceeded. Also, the licensee characterized all the spent fuel assemblies loaded in MPC-24-060 as low burnup fuel, which is permitted to reach higher temperatures in storage than fuel of other burnup levels. The HI-STORM 100 system is rated also to store high burnup fuel. As a result, MPC-24-060 has a large thermal margin. Therefore, based on the NRC staff's review of Holtec's evaluation and technical justification, the staff concludes that MPC-24-060 (loaded with the contents described in the ANO exemption request letter) inside the HI-STORM 100 system will meet the 10 CFR part 72 thermal requirements.

Based on its review, the NRC staff has reasonable assurance that Entergy's exemption request for an MPC loaded with fuel assemblies classified as having defects greater than pinhole leaks and hairline cracks will meet the thermal, structural, criticality, retrievability and radiation protection requirements of 10 CFR part 72 and the offsite dose limits of 10 CFR part 20. Therefore, the NRC staff concludes that the exemption to allow the licensee to store MPC-24-060 in its as-loaded configuration will not endanger life or property or the common defense and security.

Otherwise in the Public Interest

The information Entergy submitted with its exemption request, and the Holtec analyses documented in Holtec Report No. HI-2146265, "Justification for ANO Exemption Request for Loading of Damaged Fuel in MPC-24," Rev. 0, demonstrates that the as-loaded MPC is not compromised due to the misloaded fuel (ADAMS Accession No. ML14279A246). If the NRC did not grant this exemption, Entergy would need to take action to correct the condition by reloading the affected MPC to be in compliance with CoC No. 1014, Amendment No. 5. This would involve unloading the spent fuel assemblies from the MPC, performing inspections of various MPC components, loading different spent fuel assemblies into the used MPC or a new MPC (if there was damage noted on the used MPC) in accordance with CoC No. 1014, Amendment No. 5 and performing the MPC closing procedures.

The licensee estimates that unloading and reloading the MPC would increase personnel exposures by 600 mRem. In addition, the licensee states that unloading and reloading would generate radioactive contaminated material and waste not only during unloading and reloading operations, but also from disposal of the used MPC (if the MPC were damaged during the unloading process). The licensee estimates this action would cost an estimated \$300,000 for unloading and reloading operations. If the MPC was damaged during unloading, the licensee estimates an additional \$750,000 for purchase of a new MPC and \$200,000 for disposal of the used MPC. The licensee also states additional opportunities for design basis accidents, such as a fuel handling accident, would be introduced if the MPC were unloaded and reloaded.

Because the corrective action would result in increased radiation exposure to personnel and provides increased opportunities for fuel handling accidents which could result in radioactive material releases to the environment, granting the exemption, and allowing MPC-24-060 to remain in its as-loaded condition, is consistent with the NRC's mission to protect public health and safety. Therefore, the exemption is in the public interest.

Environmental Consideration

The NRC staff also considered in the review of this exemption request whether there would be any significant environmental impacts associated with the exemption. For this proposed action, the NRC staff performed an environmental assessment pursuant to 10 CFR 51.30. The proposed action is the approval of an exemption from the requirements of 10 CFR 72.212(a)(2), 10 CFR 72.212(b)(3), 10 CFR 72.212(b)(5)(i), and the portion of 72.212(b)(11) that requires compliance with the terms, conditions, and specifications of a CoC, and 10 CFR 72.214, but only to the extent necessary to allow Entergy to store MPC-24-060 in its current as-loaded configuration at the ANO ISFSI.

The NRC staff performed an environmental assessment and determined that the proposed action will not significantly impact the quality of the human environment. The NRC

staff concludes that there are no changes being made in the types or amounts of any radiological effluents that may be released offsite, and there is no significant increase in occupational or public radiation exposure as a result of the proposed action. In addition, the proposed action only affects the requirements associated with the fuel assemblies already loaded into the canister and does not affect non-radiological plant effluents, or any other aspects of the environment. The Environmental Assessment and the Finding of No Significant Impact were published in the *Federal Register* on December 19, 2014 (79 FR 75843).

IV. Conclusion.

Based on the foregoing considerations, the NRC has determined pursuant to 10 CFR 72.7, that the exemption is authorized by law, will not endanger life or property or the common defense and security, and is otherwise in the public interest. Therefore, the NRC grants Entergy a one-time exemption from the requirements in 10 CFR 72.212(a)(2), 10 CFR 72.212(b)(3), 10 CFR 72.212(b)(5)(i), and the portion of 10 CFR 72.212(b)(11) that requires compliance with the terms, conditions, and specifications of a CoC, and 10 CFR 72.214 for storage of HI-STORM 100 MPC-24-060 at the ANO ISFSI.

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 19th day of December 2014.

For the Nuclear Regulatory Commission.

Mark Lombard, Director,
Division of Spent Fuel Management,
Office of Nuclear Material Safety
and Safeguards.

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